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FLOOD INSURANCE STUDY

ORIGINAL

CITY OF LAKE ANGELUS, MICHIGAN

OAKLAND COUNTY

REVISED:

APRIL 15, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 260700

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Individual components of this Flood Insurance Study (i.e., text, tables, profiles, and maps) are all subject to revision as additional data become available. Because revised components may be issued separately, study users should consult the community map repository for those components that are currently effective.

In cases where this Flood Insurance Study and any components thereof warrant revision, a Revisions Description section may be incorporated into this text. When applicable, study users should refer to the Revisions Description to obtain pertinent data and information concerning revisions.

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Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

VILLAGE OF LAKE ANGELUS,
OAKLAND COUNTY, MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Village of Lake Angelus, Oakland County, Michigan, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Village of Lake Angelus to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared for the Flood Insurance Study for the Township of Waterford, Michigan (Reference 1). The data was identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the National Flood Insurance Program. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, Federal Emergency Management Agency, Chicago, Illinois for consideration for revision of this study.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (c). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were taken from the Flood Insurance Study for the Township of Waterford, Michigan(Reference 1).

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1.3 Coordination

On November 22, 1982, the results of this study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of Lake Angelus, Oakland County, Michigan. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data. Lake Angelus and Mohawk Lake were studied by detailed methods within the corporate limits.

Approximate methods of analysis were used to study all remaining areas having a potential flood hazard that did not have available detailed scientific or technical data. Galloway Creek was studied by approximate methods within the corporate limits.

2.2 Community Description

The Village of Lake Angelus is located in south-central Oakland County in southeast Michigan. The village is bordered by the Township of Waterford on the west, the Township of Pontiac on the east, and the City of Pontiac on the south. Lake Angelus occupies most of the total area of the village. The remaining areas of the Village of Lake Angelus are used for residential, agricultural, and recreational purposes. The village population in 1980 was 400 (Reference 2).

Summer temperatures in July range from a maximum average monthly high of 83 degrees Fahrenheit (F.) to the mean monthly low of 61 degrees F. Winter temperatures range from a minimum average monthly low in January of 16 degrees F. to a mean monthly high of 31 degrees F. The average annual precipitation is 30 inches, including a melted equivalent of 32 inches of annual mean snowfall (Reference 3).

2.3 Principal Flood Problems

Floods may occur at anytime of the year resulting from either rain or melting snow, long duration rain storms, or locally intense thunderstorm activity. Since the area experiences an average of 60 days per season with at least one inch of snow on the ground, snowmelt can be a definite factor in the severity of flooding events. No historical records of specific flooding events in the village are available.

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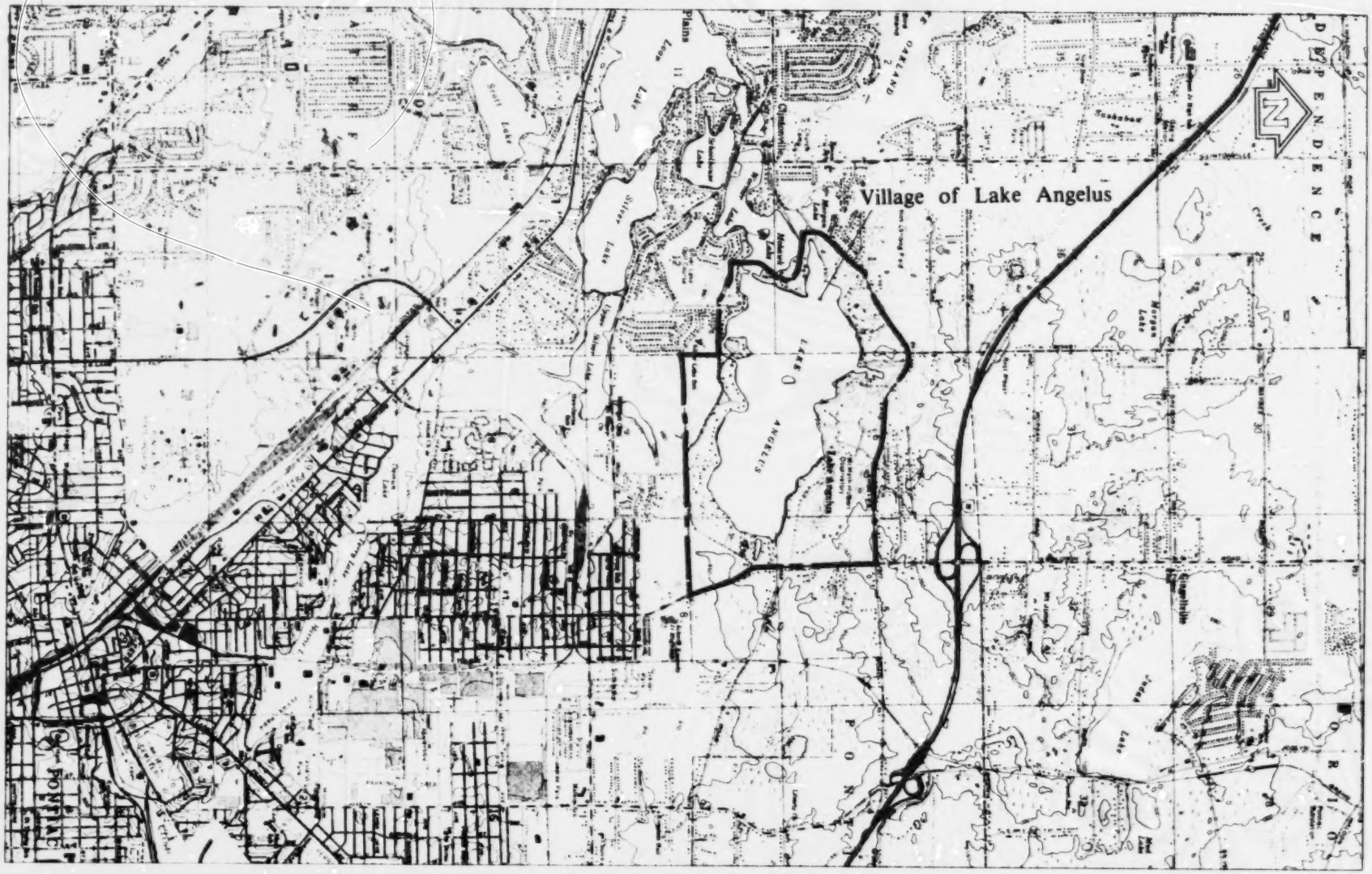

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF LAKE ANGELUS, MI
(OAKLAND CO.)

APPROXIMATE SCALE
4000 0 4000 8000 12000 FEET

VICINITY MAP

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2.4 Flood Protection Measures

No flood protection measures are in effect for the Village of Lake Angelus.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is about 40 percent (4 in 10), and for any 90-year period, the risk increases to about 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Lake Angelus and Mohawk Lake are part of a chain of lakes located on the Clinton River. Consequently, the detailed analysis for the lakes was done as part of the Clinton River analysis for the Township of Waterford, Michigan Flood Insurance Study (Reference 1).

Floodflow frequency data for the Clinton River was determined by the "Hydrological Simulation Model" (Reference 4), a report by E.F. Brater (Reference 5) and the gaging analysis (Reference 6).

The floodflow frequency data for the Clinton River at the U.S. Geological Survey (USGS) gage (No. 0416090) at Highland Road were calculated from both the gaging analysis and Brater's method. After inspection of the two methods, it was decided that the Brater method was more accurate, and therefore, the Brater method was used instead of the gaging analysis. The floodflows for the other locations on the Clinton River were determined by comparing the simulated flows from the computer study with the flow recorded at the stream gage (No. 0416090).

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3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Water-surface elevations of floods of the selected recurrence intervals for the Clinton River were computed using the U.S. Army Corps of Engineers (COE) HEC-2 step-backwater computer program (Reference 7).

The elevations for Lake Angelus and Mohawk Lake was assumed to be the energy grade line as determined at the outlet of each lake in the Clinton River analysis.

A summary of lake elevation-frequency for the lakes studied by detailed methods is shown in Table 1.

TABLE 1 - SUMMARY OF BASE FLOOD ELEVATIONS

Location	10-Year	50-Year	100-YEAR	500-Year
LAKE ANGELUS/ MOHAWK LAKE	951.29	952.56	953.16	954.71

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study (Reference 1).

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD).

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using USGS Quandrangle maps with a scale of 1:24000 and a 10-foot contour interval (Reference 8).

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Flood boundaries for areas studied by approximate methods were delineated on the topographic maps referenced above, using elevations obtained from the Township of Pontiac Flood Insurance Study (Reference 9). The boundaries of the 100- and 500-year floods are shown on the Flood Insurance Rate Map.

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the Village of Lake Angelus.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard. In lacustrine areas, reaches are limited to the distance for which the 100-year elevation does not vary more than 1.0 foot. Using these criteria, the Lake Angelus/Mohawk Lake area mapped is all Reach 1. The Reach 1 determined for the Village of Lake Angelus is summarized in Table 2, Flood Insurance Zone Data.

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

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5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Village of Lake Angelus was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
Zone A4:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 2, Flood Insurance Zone Data, summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Village of Lake Angelus is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
LAKE ANGELUS/ MOHAWK LAKE							
REACH 1	0001	–1.9	–0.6	1.6	020	A4	953

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

REVISED: 4/15/86

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LAKE ANGELUS, MI

(OAKLAND CO.)

FLOOD INSURANCE ZONE DATA

LAKE ANGELUS/MOHAWK LAKE

6.0 OTHER STUDIES

A Flood Insurance Study has been published for the Township of Waterford (Reference 1). Flood Insurance Studies have been completed for the Township of Pontiac and the City of Pontiac (References 9 and 10). The results of these studies match exactly with this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, (24th Floor), Chicago, Illinois 60606.

8.0 REFERENCES AND BIBLIOGRAPHY

1. Federal Emergency Management Agency, Flood Insurance Study, Township of Waterford, Michigan, February 1983.

2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Michigan, Washington, D.C., January 1982.

3. Michigan Department of Agriculture, Climate of Michigan by Stations, 1971.

4. Hydrocomp Incorporated, User's Manual for the Hydrological Simulation Program - FORTRAN (HSPF), for the U.S. Environmental Protection Agency, Grant No. R804971-01, September 1979.

5. Brater, E.F., A Study of Flood Conditions Along the Clinton River in the Region Which Includes the Western Part of Pontiac, Waterford Township and West Bloomfield Township, for the Clinton River Watershed Council, Keego Harbor, Oakland County Board of Commissioners, March 1976.

6. U.S. Water Resources Council, Hydrology Committee, Bulletin No. 17A, Guidelines for Determining Flood Flow Frequency, June 1977.

7. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, User's Manual, 1973.

8. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Pontiac North, Michigan Quadrangles, (photorevised 1973).

9. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Township of Pontiac, Michigan, January 1979.

10. ————, Flood Insurance Study, City of Pontiac, Michigan, February 1979.

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9.0 REVISIONS DESCRIPTION (Revised: April 15, 1986)

9.1 Purpose

The purpose of this Flood Insurance Study Revisions Description is to incorporate new and revised data into this currently effective Flood Insurance Study for the Village of Lake Angelus, Oakland County, Michigan. Since the effective Flood Insurance Study, the political designation of the village has been changed to city. The community will be referred to as the City of Lake Angelus throughout this Revisions Description. This Revisions Description is intended to provide updated information that aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

9.2 Acknowledgments

The hydrologic and hydraulic analyses for this Revisions Description were obtained from the consulting firm of Johnson & Anderson, Inc., Pontiac, Michigan. The Federal Emergency Management Agency (FEMA) reviewed and accepted these data for purposes of this revision.

9.3 Scope

The detailed 100-year flood boundary delineations for Lake Angelus/Mohawk Lake were revised based on an aerial photograph and a report prepared by Johnson & Anderson, Inc. (Reference 1).

9.4 Other Studies

The detailed 100-year flood boundary delineations for Lake Angelus/Mohawk Lake presented in this Flood Insurance Study agree exactly with the delineations presented in the report prepared by Johnson & Anderson, Inc. (Reference 1).

9.5 Location of Data

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, Chicago, Illinois 60606.

9.6 References and Bibliography

1. Johnson & Anderson, Inc., 100-Year Floodplain, Homes in the Village of Lake Angelus, Pontiac, Michigan, September 1983.

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